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Science Five Thousand Years Hence[1]

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I have been asked to predict the condition of science five thousand years hence when the Time Capsule is dug out of the Flushing meadows—provided there are any meadows here in A.D. 6939. Land has been rising and falling in different parts of the globe within historic time, and within five thousand years the Time Capsule may be considerably below sea level or raised several hundred feet above where it is now.

While I speak *to* the youth of to-day, I am speaking *for* the youth that will be living one hundred and fifty generations hereafter, in other words to your great, great, one hundred and fifty times great grandchildren.

One can predict only in terms of what is known in the past. Let us compare what has actually occurred within these fifty centuries with what a man five thousand years ago might have predicted for the present. He could not have thought about development of world civilization because the world to him was only a limited region. Civilizations could develop and decline with little or no influence on one another because of lack of means of communication. His knowledge of the geographical world and of the laws of nature was so limited that it would have been impossible for him to predict the condition of the world in 1940. Science, as we understand this term, did not exist in B.C. 3060.

Are we to-day in our ignorance as incapable of predicting the future five thousand years hence as was the man five thousand years ago? In many ways probably yes; in other ways we have an advantage. We have made a start. So

[1] Address before the American Institute of the City of New York at the World's Fair, September 23, in connection with the sealing-in of the Westinghouse Time Capsule. The address was broadcast in part over the NBC network. Reprint from *Science*.

far as his physical and his mental equipment are concerned, I see no evidence that man to-day is better than five thousand years ago. He does, however, have better tools—by tools I include the methods of science as well as the actual instruments, such as the microscope, which enable him to delve deeper into the unknown and learn the laws of nature. The development of science seems to act like a falling body in that, once started, its speed is enormously accelerated with time. There is an interrelation of science such that each new tool or method makes possible newer tools and further discoveries. In many branches, and perhaps in science as a whole, more progress has been made within the life span of a single man than in all time before.

Last week I had the privilege of taking part in the celebration of the bicentennial of the founding of the University of Pennsylvania by Benjamin Franklin. Two hundred years is not a long time so far as the recorded history of mankind is concerned. It is only a one-twenty-fifth part of the period of time we are discussing to-day. Two hundred years is a long time, however, in the history of my own field of biological research. In 1740 Benjamin Franklin and the other founding fathers of the University of Pennsylvania knew little about biology for the simple reason that biology at that time was an almost undeveloped subject. An adequate system of naming plants and animals was lacking, and it was only thirteen years later, in 1753, that Linnaeus published his "Species Plantarum" and introduced to the world the binomial system of classification which has been used ever since for the names of both plants and animals. Few of the titles of the biological papers which were given at last week's celebration in Philadelphia could have had any meaning to Franklin and his colleagues because such words as *germ plasm*, *chromosomes* and *genes* were not in use till more than a century after Franklin's time.

A couple of years ago at the Richmond meeting of the American Association for the Advancement of Science there was celebrated the one-hundredth anniversary of the cell theory. The newness of our knowledge of cells is evident when we realize that more than two thirds of the last century's study of cells is covered by the life span of one of the speakers on the program of the Pennsylvania Bicentennial. Chromosomes were discovered in 1873 when he was three years old and were given the name of chromosomes in 1888, when he was an eighteen-year-old freshman in Kansas University. An example from my own special field of genetics is the fact that knowledge of the mechanisms of heredity has been developed entirely within the last forty years. Progress was slow at first but has become increasingly rapid until now we feel justified in predicting the conscious control of the evolution of plants, animals and even of man himself. Thus in addition to having more and better tools, man, five thousand years hence, may be a better creature physically, mentally and morally.

Detailed prophecies, of course, are impossible. We can only guess at trends. The psalmist said, "Oh! had I wings like a dove, for then I would fly away and be at rest." Many doubtless have had the same desire to fly. Leonardo da Vinci less than five hundred years ago drew plans of a flying apparatus. It was only, however, after the invention of the internal combustion engine that flying became an accomplished fact. This was the outcome of centuries of yearning. We make progress in learning by yearning. If we study what the things are which mankind yearns for, we may be sure that

these will be things in which progress will have been made five thousand years from now.

We have yearned not only for wings, which we have now acquired, but also that we may fly away and be at peace. I believe within five thousand years man will have made progress in satisfying this yearning; whether by changing his environment through improvements in social organization or through changing the nature of man, we can not fortell. I believe progress is due in knowledge of how man may live in harmony and at peace in large as well as in small groups. I believe that governments will depend increasingly on expert knowledge—that we shall seek information before legislation rather than the reverse. I believe that by the scientific method we shall more effectively seek the truth and that the truth shall make us free.

Biology through the Abattoir

II. The Mammalian Lung

HELEN I. BATTLE
University of Western Ontario, London, Canada

The fresh beef, pig or sheep lung makes an excellent demonstration for the zoology class, since practically all the dissection can be carried out directly by even inexperienced students. A single preparation may serve a large group, by having individuals trace out the course of one or more of the smaller divisions of the bronchi. The final complete dissection will then afford the class as a whole a clear conception of the intricate branching of the bronchial tree.

When enquiring for the preparation at the abattoir, it is preferable to ask that the base of the tongue be included with the windpipe and lungs. The gullet usually adheres to the dorsal surface of the windpipe. The following descriptive account is based on beef material and is applicable with slight modifications to the other species.

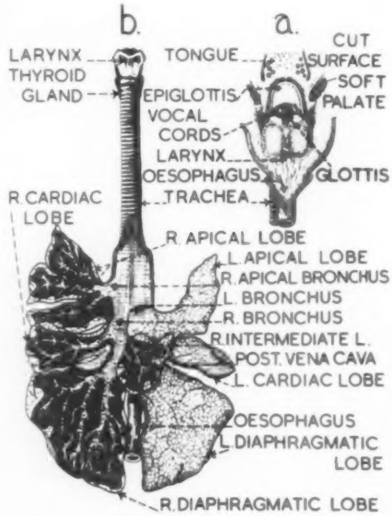
The spherical opening, the *glottis*, leading into the *larnyx* or voice-box bears on its ventral margin a short oval cartilaginous lid, the *epiglottis* (Fig. a). Dorsal to the glottis and bound to it by muscles is the *oesophageal* or *gullet opening*, which is generally collapsed and concealed from view by the larynx. Use a large probe or your index finger to locate it. Particles of food which are directed from the mouth toward the oesophagus are prevented from passing into the glottis by the lowering of the epiglottis, and the simultaneous elevation of the larynx to fit against it. That the larynx is temporarily elevated during the act of swallowing is readily demonstrated by placing the thumb and fore-finger lightly against the Adam's apple (or pomum Adami of academic circles!), at the same time imitating the transit of food by swallowing. The *oesophagus* is a soft distensible tube which may be traced to the posterior level of the lungs. Here it is often surrounded by remnants of the central tendon of the diaphragm through which it passes from the thorax to the abdomen.

The *larynx*, a short tube connecting the pharynx and trachea, is a complex valvular apparatus which regulates the

volume of air in respiration, prevents aspiration of foreign bodies and also serves as the chief organ of voice. Its skeleton is composed of a framework of cartilages connected by joints and ligaments and moved by muscles. The largest of these, the *thyroid cartilage*, is a shield-shaped structure on the ventral surface. Examination of the cavity of the larynx from the glottis reveals the presence of two short thick folds, the *vocal cords* projecting from each lateral wall. Sound is produced by the expiration of air over these cords. From the larynx to the root of the lungs the walls of the *trachea* are supported by 50 to 60 horse-shoe shaped cartilaginous rings (32 to 35 in the pig) which are incomplete dorsally leaving a soft strip into which the oesophagus fits. Attached loosely to the anterior end of the trachea is the *thyroid gland*. It consists of two lateral somewhat triangular lobes connected by a narrow ventral isthmus. In the calf and sheep it is dark reddish brown in color, in the adult cow and the pig, pale pink.

The *lungs* are most conveniently examined next. They are soft spongy, highly elastic organs. Remove several cubic inches from the tip of a lobe, place in a beaker of water and observe that it floats. The buoyancy is due to the fact that even after removal from the body, the lungs contain air entrapped in their air sacs. The color varies according to the amount of blood contained in them. During life they are pale greyish pink, but in an unbled animal are dark red. Each lung is covered by a smooth shiny membrane, the *pleura*. On the surface of the pleura small irregular areas (1 to 2 cm. in diameter) are delineated, each of them representing the base of a *pulmonary lobule*.

The lungs are not alike in form or size (Fig. b). The right is considerably larger than the left a difference correlated with the projection of the heart to the left. The *right lung* is composed of four lobes, an *anterior apical lobe* which is deeply forked; a *middle cardiac lobe*; a *posterior lateral diaphragmatic lobe*; and a *posterior median intermediate lobe* which projects into a pocket supporting the posterior vena cava. The *left lung* has three lobes, an *anterior apical lobe*, a *middle cardiac lobe* and a *posterior diaphragmatic lobe*.



a. Pharyngeal region of ox. Oesophagus has been slit along mid dorsal line and reflected.

b. Ventral view of larynx, trachea and lungs. Bronchial tree of right lung dissected to show larger branches.

There are three chief *bronchi* which may be observed at the root of the lung. The bronchus for the right apical lobe is given off from the trachea about three or four inches anterior to the bifurcation of the latter into right and left bronchi which takes place at the level of the left apical lobe. Each bronchus enters the corresponding lung and divides, like the limbs of a tree, into a number of smaller branches. Make a median ventral incision in the trachea and carry it posteriorly into the bronchi and their various

subdivisions.

By repeated branching each bronchus becomes progressively decreased in size, the smaller divisions (about 1 mm. diameter) being termed *bronchioles*. Note that the combined cross sectional area of any of the branches is always greater than that of the parent stem. One bronchiole passes to each lung lobule. The cartilage in the walls of the large bronchi is in the form of rings. In the smaller bronchi it occurs as isolated flakes, which become smaller and fewer in number with each successive branching of the bronchial tree, and eventually disappear in the bronchioles. The latter may be dissected open lengthwise under a hand lens with a fine scissors. The bronchioles subdivide and lead into chambers lined with alveoli, the ultimate respiratory units of the lung. W. H. Lehmberg, a scientist of the American Optical Company, has recently calculated that the entire internal surface of a normal human lung is equivalent to a strip of land occupied by a house thirty-one feet square.

Branches of the pulmonary artery and pulmonary vein frequently are observed extending along the bronchi; their function, respectively, is the transportation of blood to and away from the alveoli.

Odd Sticks

J. WALTER WILSON
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The objectives of *The National Association of Biology Teachers* as expressed in Article II of its constitution are concerned primarily with the improvement of the quality and efficiency of Biology teaching. There is a problem which is related to, and appears to me fundamental to, this primary objective which is worthy of discussion, that is, the dignity not only of Biology but of scholarship in general in secondary school teaching. The problem rests squarely on the shoulders of the teachers themselves.

The first step in its solution is to establish some assurance that the job itself is a worthy one. This is, I realize, a difficult thing to do in these days of mass education, where the teacher easily comes to feel himself a mere cog in a vast machine, a slave to a system of syllabi and co-operative examinations, where all his plans are made for him and standardized tests are imposed to take the place of his judgment. It has become customary to lay most of our troubles at the feet of the bugbear "Mass Education"; and to use this bugbear as an excuse for not even attempting to solve our problems.

I do not believe that all the problems of education came with mass education, any more than I believe that all the problems of society came with the industrial revolution.

Much as we would like to return to a simpler and more individualistic type of education, it is quite clear that it will not be accomplished in the near future, perhaps never.

Edsel Ford, questioned by a Congressional committee on the effect on labor of the highly mechanized mass production of automobiles, is reported to have replied that a Ford car made by hand would cost about 70,000 dollars, and

with luck about 50 a year could be sold in America. How many men would it take to make them and keep them running? We may conclude that if everyone is to have the fine transportation which cars like the Ford give it is necessary that we have mass production.

If we were to dispense with mass education could we afford a comparable education for everyone as an individual project? Could we indeed find enough competent people to staff the program? And if found could society spare them from other jobs that have to be done? The answer to such questions is necessary to the solution of the problem that mass education presents. It is a long-time proposition. We cannot afford to wait for its solution, before tackling other and more immediate problems.

One of these immediate problems is how to retain in the goose-step of mass education the self-respect of the individual teacher and incidentally the respect of the students and of the community for his job. It seems to me that, as a whole, teachers need an increased assurance of the dignity of scholarship, and a more thorough-going realization of the magnitude of their responsibilities even under the goose-step.

I should like to emphasize an aspect of the teacher's responsibility which even alone should make his task worth while. It is his responsibility to one particular class of individual students. Two groups of individuals that stand out from the mass are adequately cared for. The really backward student is officially recognized and provided for in the system itself. The bright student naturally commands the individual attention of the teacher. From the teacher's point of view it is an easy and pleasant duty to give it. The alert student is a joy: he gets the point quickly, learns easily, passes excellent tests, is able to do with enthusiasm any task set before him, and, if he doesn't get a swelled head, is attractive and pleasant to have around. It is with students of a third type, neither backward nor precocious, that I believe the greatest and most difficult responsibility of the teacher lies. I have called them ODD STICKS,[1] they are the eccentrics, the budding geniuses. They are not at all to be confused with the precocious, for, although they may sometimes be precocious, geniuses are often the reverse, very slow in maturing. The precocious child really needs very little individual attention. In fact, it may tend to spoil him. He needs, as a matter of discipline, to be left to solve his own problems within the system. And he is quite capable of solving them. Individual attention may encourage him to substitute his personal attractiveness for real work; he becomes a teacher's pet. I would suggest as an interesting task for a thesis in the department of education, the ultimate fate of the teacher's pet. The incipient genius, on the other hand, judging from the evidence of biographical records, most frequently stands out in childhood only as an ODD STICK uncomfortable to have around. He is apt to be chasing butterflies when he should be doing his Latin; to be apparently sulking while other children are playing; to be dreaming perhaps of some great and distant achievement while his guidance teacher is trying to inculcate in him the horror of a dirty neck. If he asks a question, it is much more likely to be apparently irrelevant than to lead to the next thing the teacher was going to say anyway.

Unfortunately, since we are not able to read minds, we cannot tell whether

[1] Dr. George Sarton discusses them in *Isis*, vol. xxx, p. 6, under the title "Ugly Ducklings." His thoughtful article should be read by every educator.

such a child is thinking of important things or not. Herein lies the greatest challenge to the teacher: to sort out such children from the dullards they may in some ways so closely resemble. What to do with them when discovered is another question. I think it very doubtful if we can direct the development of genius, let alone produce it. But we can kill it. Teachers who have to their credit many great names have played a largely negative but not unimportant role in developing them. This role is one of protection. It is the essence of our system that, for smoothness of operation, everyone must conform. In the case of the majority of students this is perhaps not undesirable. A genius, however, is an exceptional individual; trained to conformity, he is no longer a genius. It is the responsibility of the teacher to shield genius from the pressure of the system and permit it to develop. Obviously this can't be done for every rebellious youngster or the system would break down, so the task begins with the discovery of genius. How can we recognize it?

There are no simple criteria. But from a little experience and much reflection, I have a suggestion to make. I make it with some hesitancy, for in these days when, in one form or another, a broad, well-rounded education is the declared objective, and its success is judged by a comprehensive examination of ever widening scope, it seems anomalous to speak of purpose. It has become a byword that even college students do not know what they are going to do in life, and hence should be given a well rounded education to prepare them for any niche they may happen to fall into. This is true in every way for most students. From the point of view of the welfare of society it is probably for the best. Even in after life, the majority of individuals have no all-consuming ambition for which they are willing to labor and to sacrifice. Their objective is, for the most part, general, and in terms of Success with a capital S, measured in terms of comfort in a given standard of living. For these people "education for leisure" may be a good slogan. The genius—anyone who attains to great achievement—is different. He has no leisure, his whole time and strength is absorbed in the attainment of his purpose. This is what makes him in manhood eccentric, in youth an ODD STICK.

You may question the existence of purpose in the minds of the very young. We find it occasionally in the college student but I am sure it is rarely developed at that level. If it comes at all it comes much earlier. The students who have a real purpose in life have it already established before they come to college.

I had some illustrations from the biographies of great scientists to bring home this point; for example, how near Linnaeus came to being a shoemaker because he was so poor in school; but in spite of their authenticity these are easily suspected of apocryphal origin. It seems incredible that a mere child should envision in any detail the future course of his life. Indeed those who deny it the loudest claim inside information to the contrary. But I know a professor in an American university whose present position and life work represents the achievement of an ambition conceived when, in the fourth grade of a school in Holland, he heard a lecture which would ordinarily be considered over the head of any child. This is of course an isolated case—but the people we are talking about are characteristically isolated cases. Obviously, we cannot frame a program of general education on the needs of isolated cases.

But the fact that they are isolated cases should not lead us to neglect them, for they are the ones that society needs most. Their very rarity makes the need of them more urgent.

I think, then, that one of the greatest responsibilities on the shoulders of the teacher is to discover and protect these individuals. How to discover them is doubtless an art verging on the occult. I have only one practical suggestion: be alert to discover purpose in the ODD STICKS.

If a genius is discovered we must be content with a passive role. We must not try too hard to direct and force its development. It is important that these youngsters go a long way but they don't have to get there quickly. There is a false notion afoot that the great work of the world is done by young men and we could well afford to chloroform the old ones. Statistics prove quite the contrary. A study of the ages at which scientists, musicians and literary men produce their masterpieces indicates that the average age is around 55. Maturity is the result of an internal process that apparently has to go at its own rate. Patience, sympathetic appreciation, and protection is our greatest contribution. That may seem a small contribution, but I am sure it will loom large if you look backward and evaluate the contributions of those who have "taught" you.

Just a word in closing about the other problem—the maintenance of the dignity and worth of scholarship. It is an age-old problem and is going to become greater in the years just ahead. The difficulty that it rests upon is deep seated. It may be presented in the words attributed by Boswell to Dr. Johnson. "Were Socrates and Charles the Twelfth of Sweden both present in any company, and Socrates to say, 'Follow me, and hear a lecture in philosophy'; and Charles, laying his hand on his sword, to say, 'Follow me, and dethrone the Czar,' a man would be ashamed to follow Socrates."

The solution of the problem will not be arrived at by attempting to exalt scholarship above the other activities of mankind. We must rather realize that men are complex. If they follow Charles the Twelfth today, they may sit with Socrates tomorrow. Milton's *L'Allegro* and *Il Penseroso* may be not two individuals but moods of the same individual. Humanity cannot be wooed completely from the strenuous life nor from pleasure. But most men have a place in their make-up and a time in their lives for the pursuit and enjoyment of scholarship. Those of us who are devoting our lives to learning do our first duty to it by maintaining in our own lives its dignity and worth, and by keeping alight the torch that is to light the fire in others.

WINTER FIELD TRIPS

All too frequently, biology field trips are conducted on the fair weather basis. When the ground freezes and snow covers the landscape, many biology classes put away nets and collecting equipment and wait until spring before they venture forth.

We have found that winter weather is no excuse for discontinuing our trips. The students seem to enjoy the crisp, cool air and if properly dressed, particularly in the matter of footwear there can be no ill effects as a result of an hour out of doors. Such an activity as this seems very essential as it is only natural for students to wonder what happens to the multitudes of insects they see in September and October. To merely say that "they hibernate" is inadequate. A few

hours spent in the open will answer their questions far better than lectures, books or pictures can ever hope to do.

A short walk along any pond or river will furnish many kinds of plants such as cat-tails, rushes, and the like. These are taken to the laboratory and split open. A surprising number of insect larva are found embedded in the pith, thus giving the students their first answer to the question of how the insects spend their winter. At the same time that we are gathering these plants, many cocoons of moths and butterflies are found. Brought into the laboratory and hung up, several of these hatch out weeks later.

Under the barks of dead trees and logs, beetle larvae are very numerous. Spider egg cases and nests of mice are also common. We also bring back several of the egg cases and they often hatch in the lab. One of the most interesting parts of this work comes from the examination of a pail of frozen earth. With a spade or pick-axe we dig up a small amount of soil and when we have returned to the laboratory place it in a pail of luke warm water. By continually stirring the contents of the pail and keeping a close watch of the surface of the water we find a surprising number of insects that bob up to the top where they can be collected. A few mouse traps set in the snow near holes or where tracks are numerous will catch many mice and nearly always one or more shrews. This latter animal is an item of a great deal of curiosity and interest as most of my students have never seen one. Eggs of the grasshopper are not uncommonly found among the roots of grass.

Still another source of some very interesting material will be the streams and ponds. By dragging a piece of wire with a hook on it across the bottom one can pull up large amounts of vegetation that is completely submerged. Upon close examination, this material will show large number of the nymphs of such insects as the stone fly and dragon fly. After this exercise the term "aquatic insect" will have a much more forceful meaning to the students. These insects make valuable additions to the aquaria where they command continued interest.

Some of the more interested students make a comparison of the different species and the total number of individuals over areas of the same size but having a different type of habitat. It is not necessary to identify each species: only recognize that more than one exists. By listing the general type, such as, "beetle larvae" or "spider," and after it the number of individuals in columns, we can easily make a table for each habitat for purposes of comparison.

These items represent only a few of the ways that we attempt to teach our students that biology is never "dead." That even though there may be a heavy blanket of snow over the earth, under a protective coat of one kind or another, the myriads of organisms we see in the summer are only temporarily out of sight.

Douglas Salisbury,
Warren Township High School,
Gurnee, Illinois

AN OPEN LETTER TO FILM PRODUCERS

From all sides we are beset by social, economic, racial, and political problems, the solution of which all must share. Many have had limited experiences in travel, so it is difficult for us to look at these questions with an open mind and to gather facts from all sides before drawing conclusions. What can the movies of today do to help us share the

burdens of others and to be of assistance in solving world problems?

Some excellent films have been produced. Who was not thrilled with the Life of Pasteur and the noble deeds of Florence Nightingale as only a moving picture can portray their characters and their struggles to carry on research problems? I wish Yellow Jack had done as well by the men who conquered yellow fever and malaria.

Wouldn't it help to fight harder to control tuberculosis if we had a film telling of the work of Koch and Trudeau? It could be brought closer to all individuals by showing the modern methods of prevention, hospitalization, and rehabilitation. Untold lives could be saved from unnecessary suffering.

If we had a film depicting the life of Mendel working out his problems and laws of heredity, couldn't it carry to the public suggestions for modern-day applications of improving plant and animal life through crossbreeding and selection? What opportunities there would be to apply this to modern problems of eugenics and euthenics and the development of a better race! If more people realized that the laws of heredity are like a chain binding and controlling our lives in untold ways, wouldn't it help in having better cooperation from the public in preventing the over-production of defectives?

There is a wealth of material that could be used in making thrilling and fascinating films showing the growth and development of plants. Much has been done by Mr. Pillsbury, but little of his work has been put before the vast public who attend the movies. I have heard adults gasp at the exquisite beauty of an unfolding flower. Here is an opportunity for us to learn life-truths as they are found in plant and animal life. We can be inspired to carry on experiments in hybridization and the development of new plants and animals as a hobby.

Couldn't we have a film telling us of the life of Luther Burbank, climaxing it with the industries of today which have resulted from the new fruits, vegetables, and flowers he gave us?

How few of us know anything about the history of the development of various plants and animals so essential to our modern living? What a fascinating film could be made showing the history of the horse from its four-toed stage in prehistoric days and following its development and changes throughout the ages until we have the many species and varieties of that family scattered over our earth today. Similar films could be made of cattle or dogs. Such plants as the orange, peach, apple, or wheat would supply much interesting material.

Paleontologists and archeologists could supply a vast amount of material showing the history of man.

Conservation is a problem for every American citizen. We need to be ready to help solve the problem of the Joads, but couldn't a film be made to show the cause of their predicament? Farmers and city folk alike need to share this problem and to work out methods of prevention of soil erosion. Films could be made showing the mistakes of the past in their methods of tilling the soil, lumbering, grazing, and destruction of the homes of wild animals which are needed to keep nature's balance.

The recent film, The Magic Bullet, which portrays the courageous spirit of Dr. Ehrlich cannot help but arouse within us a greater desire to know more about our own body, how it functions and how to properly care for it. Couldn't our actors and actresses show better posture for adolescents to imitate; better health rules and a higher standard for building a fine, healthy body?

I would like to see more films like Pasteur and Ehrlich that inspire people with the scientific spirit which wants to reach the root of the trouble rather than be satisfied with a little superficial knowledge. The scientific spirit leads us to study and know all the conditions of the problem and to interpret it in all of its relationships before we draw our conclusions.

May we have the courage of Pasteur, Ehrlich, or Curie!

ARABEL CAMPBELL,
James Monroe Junior High School, Seattle, Washington

Biological Briefs

RUTH SHERMAN

COLBERT, EDWIN H. *Mammoths and Men.* Natural History 46: 96–103. September, 1940.

Great herds of mammoths, descendants of an earlier mastodont stock, arose in Pleistocene times and spread throughout Europe, Asia, and Africa, and then to North America. Although none reached Australia or South America, the latter continent had several types of mastodonts. As primitive man developed and devised hunting techniques, he must inevitably have clashed with mammoths. Thus we have the fossilized leg of a mammoth in which a spear-point had been imbedded, as well as deposits of the bones of this animal intermingled with primitive human artifacts. Probably early man more frequently devised pitfalls for his huge prey, killing them by dropping heavy stones upon them. The most famous woolly mammoth cadavers ever found were those frozen in the Siberian ice, and upon which Russian scientists banqueted in 1900. At the end of the Ice Age occurred a relatively sudden extinction of most types of proboscideans throughout the world, its cause undetermined; only the African and Indian elephants remain as present-day survivors of a once-mighty clan. As supplements to this article, there appear a chart on the geographic origin and distribution of elephants, and photographs of a recently excavated deposit of shovel-jawed mastodons in Texas.

ROWE, DOROTHY PARKER. *Shelled Aristocrats.* Nature Magazine 33: 451–456; 490. October, 1940.

Nuts are of importance economically as well as gastronomically. One-fifth of our domestic nut production is harvested from wild trees, of ten native species. Except for large paper-shelled pecans grown from budded and grafted stock, most pecans come from wild trees growing in the river bottoms of the southern states. The production of black walnuts has never satisfied the demand for them, mainly because of the commercial value of the wood. Lesser known natives include butternuts, hickory nuts, and beechnuts. The pinyon, or "pine nut" long harvested by the Indians of the Southwest, has recently been adopted commercially. Nuts of foreign origin now domesticated include the Persian (English) walnut, the almond, the filbert (sometimes hybridized with the native hazelnut), and the peanut. Since the chestnut blight has almost exterminated our native stock, these nuts are now mainly imports. Cashews, pistachios, coconuts, Brazil-nuts, and pili nuts are also imported. The most valuable nut by-products are copra and oils. This issue of *Nature Magazine* also includes an article on pinyon pines and a valuable illustrated educational insert on nuts.

(Continued on page 140)

FINANCIAL STATEMENT

THE NATIONAL ASSOCIATION OF BIOLOGY TEACHERS
Year ending June 30, 1940

Receipts

Memberships	
1939–40	$1,479.00
1940–41	110.00
1941–42	3.00
Advertising	1,554.97
Miscellaneous	25.18
Total	3,172.15
Bank Balance 7/1/39	236.94
	$3,409.09

Expenditures

Journal	$2,078.97
Association	587.16
Total expenditures	2,666.13
Bank Balance 7/2/40	742.96
	$3,409.09

Assets

Bank Balance	$ 742.96
Accounts due (Advertising)	509.12
Supplies & Equipment (Est.)	75.00
Address stencils (Est.)	75.00
Back Copies (Est.)	350.00
Total	$1,252.08

Liabilities

Advance payments of memberships	$ 113.00
Accounts payable	
Journal	663.31
Association	11.99
Total	788.30
Credit Balance	463.78
	$1,252.08

P. K. HOUDEK,
Secretary-treasurer.

We hereby certify that the books of the Secretary-Treasurer of *The National Association of Biology Teachers* for the year 1940–1941, ending June 30, 1940, have been examined by us and that the above report is correct in every detail.

Miss Iva Spangler, Chairman, Central High School, Fort Wayne, Indiana

Mr. H. H. Michaud, North Side High School, Fort Wayne, Indiana

Mr. A. B. Krom, Wabash High School, Wabash, Indiana

BOOK REVIEWS

One of the functions of THE AMERICAN BIOLOGY TEACHER is that of serving as a medium for the presentation of facts and the exchange of opinions regarding current books on biological subjects.

The reviewing of high school texts in biology has been entrusted to Mr. Alan A. Nathans, associate editor, and his corps of assistants chosen from various regions of the United States and Canada. We are greatly indebted to them for their untiring efforts at this important task. In assigning other books for review, our aim is to enlist the services of some person who is specially qualified through training and experience to faithfully present the facts and to evaluate the book as a whole.

Readers have expressed approval of the policy of publishing critical reviews, especially with respect to textbooks and laboratory manuals. Such reviews, naturally, involve the element of judgment on the part of the reviewer. So long, however, as the statement of facts is accurate, and the facts are kept distinct from the opinions of the reviewer, it seems likely that a real service will be performed. Teachers of science are perhaps better qualified than most individuals to differentiate between facts and opinions; for they are constantly engaged in the practice and the teaching of the scientific method.

In many cases the conclusions of reviewers do not express the opinions of the editorial staff; nor is it probable that they always reflect the judgment of the majority of teachers. Nevertheless, we think that greatest progress will be made through a policy of publishing the reviews as submitted.

Our columns are always open to teachers and authors who may feel that a book has been unfairly dealt with in a review.

President's Page

"PROFESSIONAL RESPONSIBILITY"

A few weeks ago I visited a well-known scientist in his laboratory. Besides doing his own researches and directing those of his staff, I found that his evenings were occupied in making a synthesis of everything that had been done in his field for the past year. This latter was a stupendous undertaking, involving as it did the digesting of something like twelve hundred papers.

"Since there is nothing in it for you but a lot of hard work, why are you doing it?" I asked. His reply was simply: "Professional responsibility, I suppose."

My thoughts flashed to the National Association of Biology Teachers. "Why else," I asked myself, "does Houdek devote hours on end to keeping up with the multitudinous details of our organization? Why else does Colin pore over manuscripts month after month? Why else do Fried, Stephens, and the others do what they are doing?"

Again, I thought of the various professional organizations to which I belong. Apart altogether from the president who may be president only because of the honor of the office, you will find in every organization certain "wheel horses" upon whose shoulders fall most of the responsibility. And their shoulders seem to be made for carrying burdens if we may judge by the ease with which all sorts of odd jobs are shifted to them.

The National Association of Biology Teachers is well supplied with such willing workers, but I am wondering if the time is not here when the burdens should be more widely distributed. The word "burden" is used inadvisedly, for in every case, the work has been cheerfully assumed, and, to get the organization underway, everyone was willing to take on more than his or her share. Each has been willing to do it from a sense of professional responsibility.

Now the association is on its feet and in an enviable position to serve biology teaching. The Board of Directors does not own it; it belongs to the teachers of biology in the secondary schools.

Its future growth, its policies and its management must be determined by its membership. The board honestly attempts to reflect the wishes of that membership, a difficult undertaking unless individual members and affiliated groups make known their wishes. The humblest member has as much at stake and as much right to express an opinion as the greatest.

Won't you accept it as your professional responsibility to do your part in making the National Association of Biology Teachers what *you* want it to be?

THE NEXT ANNUAL CONVENTION OF *The National Association of Biology Teachers* will be held in Dallas, Texas, December, 1941, in connection with the winter meeting of the American Association for the Advancement of Science. This has just been decided by our executive board meeting in Philadelphia. It is sincerely hoped that a large number of our members from the South and West who have been unable to come to previous conventions will be in attendance.

DR. E. LAURENCE PALMER, Professor of Rural Education, Cornell University, and Mr. M. C. Lichtenwalter, Lane Technical High School, Chicago, have been elected to the Advisory Staff.

Third Annual Convention Held in Philadelphia, December 30, 1940

Prefaced by Meetings of the Executive Board and the Editorial Board on December 28 and 29, *The National Association of Biology Teachers* held its Third Annual Convention in Room 100, Hare Hall, University of Pennsylvania, Philadelphia, Pennsylvania. This meeting was a part of the Annual Meeting of the American Association for the Advancement of Science.

During the day 131 members and visitors registered at the Convention. They represented 21 states and 10 affiliated local societies. President George W. Jeffers acted as Chairman of the meeting, presenting the program which had been prepared by President-elect Homer A. Stephens. In the morning session there were five papers as follows:

1. "How Biology Teachers Can Use A Museum" Charles E. Mohr, Academy of Natural Sciences of Philadelphia, Pa.
2. "The Role of Paleozoology in Modern Biology" B. F. Howell, Princeton University, Princeton, N. J.
3. "Guidance Through the Teaching of High School Biology" Mary Oliver Ellington, Needham B. Broughton High School, Raleigh, N. C.
4. "Working With Chromosomes" Berwind P. Kaufmann, Carnegie Institution, Cold Spring Harbor, L. I., N. Y.
5. "An Inventory and Accounting Just Rendered by Thirty-Two Hundred Teachers of High School Biology"[1] (partial results from a questionnaire) Oscar Riddle, Carnegie Institution, Cold Spring Harbor, L. I., N. Y.

Many of our members attended the luncheon of the American Science Teachers Association, where Dr. Albert F. Blakeslee, President of the American Association for the Advancement of Science, gave an illustrated and impressive talk "Taste and Smell."

The afternoon session included the following six numbers:

6. "Photomicrography for the Advanced Beginner" John B. Lewis, 8026 Frankford Ave., Philadelphia, Pa.
7. "Biology and Wildlife Conservation" Logan J. Bennett, Penna. Cooperative Wildlife Research Unit, State College, Pennsylvania.
8. "Trichinosis" L. O. Nolf, University of Iowa, Iowa City, Iowa.
9. "A Scientist's Responsibility in Sex Instruction" Alfred C. Kinsey, Indiana University, Bloomington, Indiana.
10. "Biology and the Newer Philosophy of Science Teaching" Nathan A. Neal, James Ford Rhodes High School, Cleveland, Ohio.
11. "The Significance of Adolescent Interests in Biology" Herbert S. Zim, Ethical Cultural Schools, New York, N. Y.

It is planned to publish a number of the above papers in future issues.

The Annual Banquet was held in the east room of the Robert Morris Hotel at 6:30 P. M. At this time ninety-five members and friends of the Association enjoyed an informal program of presentations followed by an address of unusual interest and scientific significance, "The Place of Biology in Democracy," by Dr. C. C. Little, Director, Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Maine.

The Convention was marked by a spirit of cordiality and enthusiasm for the work of the Association. A number of new members were secured and all were pleased with the arrangements that were made by the Delaware Valley Biologists Club, who were hosts at this Annual Meeting.

P. K. Houdek,
Secretary-Treasurer

[1] Dr. Riddle's article will appear in the February issue.

A Simple Method of Mounting Small Exhibit Specimens of Mammals and Birds[1]

CLYDE E. KEELER
The Wistar Institute

At regular intervals, biology teachers are confronted with the problem of presenting their work graphically to boards, patrons and laity. Biology teachers in high schools and colleges are frequently charged with the task of preparing such exhibits in order to found or expand the Museum of the Biological Department as a teaching adjunct. Because an expense acount seldom envisages the preparation of these demonstrations, professional assistance cannot be readily procured.

It is for the above reasons that I believe my simple method of mounting small mammals is worth placing on record. This technique was first applied to mouse specimens exhibited at the Harvard Tercentenary in 1936, and more recently it has been employed on rats for the museum collections of the Wistar Institute, where they will be pointed out upon request. There is no reason why this method can not be readily extended with modifications to small birds and mammals generally.

For the sake of simplicity I shall here describe the method as applied to the rat. First, kill the rat with a lethal dose of ether, or chloroform or by some other method that will not harm the anatomy.

Inject 10 cc of 40 per cent. formaldehyde into the thoracic cavity and another 10 cc into the abdominal cavity, massaging the animal to distribute the injection fluid within the body cavities. Inject small amounts into the legs and subcutaneously over the body.

Within 15 minutes to half an hour subsequent to this injection the body will stiffen. When fairly rigid, place the rat upon a small temporary base-block of wood in the position desired for the finished specimen. Brad the rat's tail to the block. Then brad the four feet to their proper positions bending the body into the pose desired. The hips may be prevented from moving laterally by hammering several 7-penny nails into the block adjacent to the hips. The head may be held up by resting the teeth on a block of proper dimensions. See Fig. A.

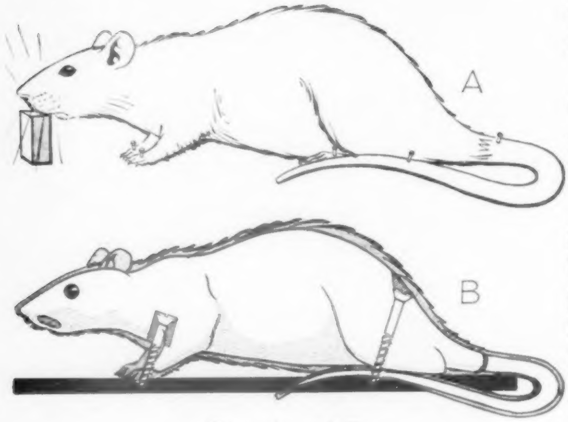
When the animal is in the position desired, allow it to stand an hour or so until it has completely hardened.

Invert the specimen and wash it thoroughly under a faucet so water will wet the whole outer surface of the skin. Place the inverted specimen, block and all, into a jar of formalin and allow it to stand 24 hours. The previous washing removes all air caught in the fur that might prevent areas of the skin from coming in contact with formalin.

After the specimen has cured 24 hours in formalin, wash under the faucet for a few minutes to remove all traces of formalin, which will attack the skin of the operator's hands, unless they are otherwise protected.

Lay the specimen on its back, and with a sharp razor blade cut the skin along the mid-ventral line from throat to geni-

[1] Reprinted in part from *Science*.

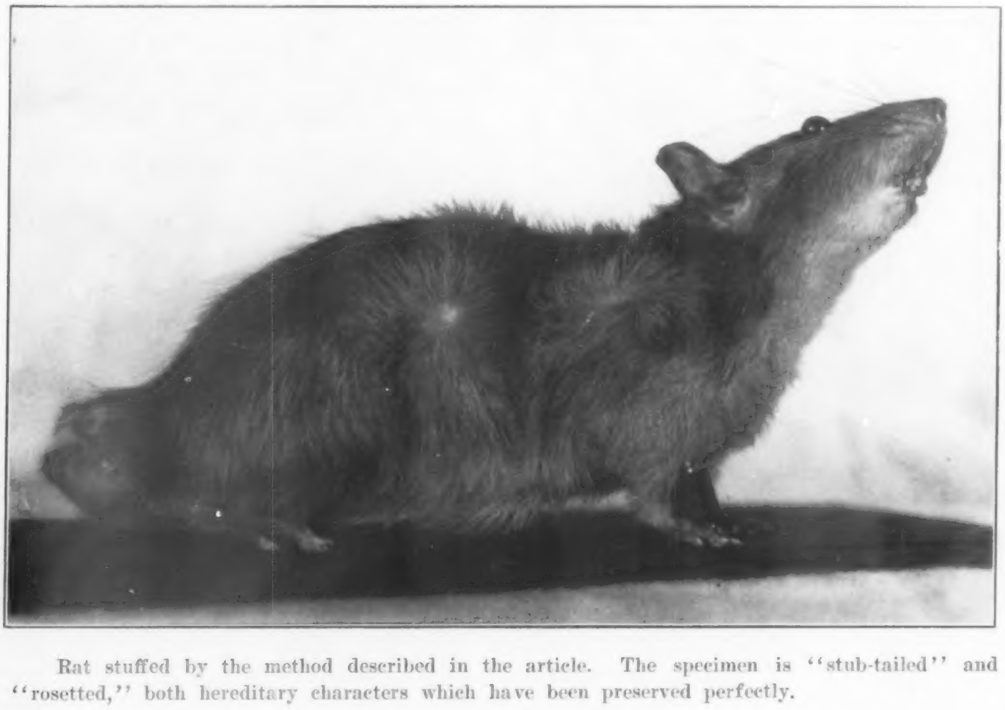


FIGS. A. and B.

tals. Cross-slit between the two wrists and also between the two ankles. Now skin the animal. Wash from time to time to remove formalin from the interior. Sever the feet, leaving them attached to the skin of the legs. By first rolling the tail vigorously, the skin of this appendage may be readily slipped off. If difficulty is here encountered, a slit may be made along the ventral surface of the tail.

The detached skin, which tends to retain the shape of the posed specimen, is put back into the jar of formalin to harden further.

The body is then placed in its normal position in a small box to support the body mold which is cast from hide glue, plaster or a recently patented substance known as Plastico which has an agar base. When the mold has hardened, slit it longitudinally and remove the body. Cast a duplicate body in the mold with plaster or wax, preferably the former. Any projections produced in casting the body may be cut away with a knife and any depressions that may ocur can be filled with Plasticine. The tail skin may be filled with plaster, wax or fine lead shot. Arrange a permanent black wooden mounting and adjust two screws to run through the plaster body sagitally so as to hold the finished specimen in the



Rat stuffed by the method described in the article. The specimen is "stub-tailed" and "rosetted," both hereditary characters which have been preserved perfectly.

position desired. See Fig. B.

Set artificial eyes (beads or glass pin heads) in their depressions on the head of the plaster body. Wash the skin in water. Dry it with paper towels. Slip the skin over the plaster body and sew up the one longitudinal and two cross-slits.

Brad the feet to their proper positions. In life such regions as ears, eyelids and toes are pink, due to the presence of subcutaneous blood vessel distribution. These areas may be tinted lightly with red ink mixed with water to produce the appropriate shade.

Adjust eyelids, nose, ears and feet from time to time until the finished specimen hardens.

Two great advantages of this method aside from its simplicity are, first, that each individual retains its individuality of form and, second, that each specimen may be caused to assume any one of a great variety of possible poses.

The Aquarium as a Teaching Device

JOHN BREUKELMAN
Kansas State Teachers College of Emporia

Few pieces of biological equipment admit of such varied uses as does the aquarium. Still it is very much neglected as a teaching device. Many instructors think of it only as a scientific or popular display item which has but little everyday use in teaching. It is good for display, but it is also a laboratory of biological processes as well as a bit of the field brought indoors.

The aquarium covers a wide range of interests and educational levels. The kindergarten child is interested in the little bunches of eggs which the snail has deposited on the glass wall; the same bunch of eggs is of interest to the college student who may get his microscope and study their embryological development.

Almost every general phase of biology can be studied in some connection with the facilities of the aquarium. This paper is merely a list of suggestions gathered from various sources; nothing original is claimed for any of them. Some of them have been submitted by kindergarten and elementary school teachers, others by high school teachers and a few by research biologists. All of them are known to be practical under ordinary laboratory conditions, having been tried out by either myself or my students. They can of course be subdivided or enlarged upon by any interested teacher.

The aquarium may be used as the basis for a teaching unit, the extent and scope of which would depend a good deal on local conditions. Many of the following suggestions come directly from the list of problems included in a unit on "The Life in a Balanced Aquarium."

Any of the following suggestions may serve as individual, group or class projects. Teachers whose classes are on a project basis can select those which are suitable. The obvious limitations are time, space, and physical equipment.

1. Building the Aquarium

An aquarium need not be expensive; it may be only an enameled pan or a fruit jar; a discarded battery jar or car-

boy. It may be built at home or in the industrial arts shop. A heater may be only a light bulb. The construction of gadgets for heating, cooling, circulating, aerating and siphoning offers an opportunity to correlate biology with physical science and industrial arts. Considerable ingenuity may express itself in the placing of rocks for hiding places, planting of different types of aquatic vegetation and simulating of various kinds of habitats. In one end of the aquarium rocks and soil may be built up above the water level so as to produce shore-line conditions.

2. Stocking the Aquarium

Much of the living material for the aquarium can be obtained by local collection, which may be done incidentally as a part of general field study or made the occasion for one or more special trips. Once pupils become interested they will keep the teacher pretty well supplied. Selection of inhabitants for the aquarium offers an opportunity for studying the relation between the organism and the type of habitat. Running water plants and animals should ordinarily not be collected unless they can be put into a circulating or running water aquarium. For the ordinary jar or tank organisms from a clear quiet pool are best. We have successfully grown water cress from a spring-fed stream by fastening it in a running water aquarium, directly beneath the water inlet.

3. Maintaining a Supply of Organisms

We regularly take from our aquariums for use in classes various algae and protozoa, hydra, rotifers, snails, daphnids and other small crustacea, crayfish, water insects, tadpoles, minnows, elodea, eel grass and many other forms. A fairly large aquarium provides a constant source of living material, which is a valuable feature in the winter. It also gives students who are interested in collecting aquatic organisms a place where these may be seen and studied later.

4. The Study of Structure

Living plants and animals in many cases differ markedly in general appearance from preserved ones. When the pupil has seen masses of Spirogyra, the gills of the mud puppy or the fins of a fish at close range in their living state, he has not only a true picture of their structure in life but also a basis for interpreting similar material in preserved form when he later encounters it. The necessity for the structural basis of classification may be emphasized by comparing the different adaptations to water life. The pupil who has watched hydras, insects, snails and fishes living in the same environment can understand why habitat is not a suitable basis for classifying them. When he has seen a crayfish and a catfish trying to eat the same bit of food he understands why food habits would not be a practical basis.

5. Growth and Development

We have observed in the aquarium growth and development in the frog, catfish, guppy, snail, mosquito, dragonfly, crayfish, daphnia, leech, hydra and other species. In some cases the entire life history from egg to adult has been studied, in other cases only certain significant stages. With the variety of animals that is available in most localities almost every phase of reproduction can be studied to advantage. In the case of plants, we have seen both vegetative and sexual reproduction in the eel grass, the formation of roots on the stems of elodea, all reproductive stages in filamentous algae, the rapid multiplication of the duckweed and other floating forms, free

algae suddenly appearing in such numbers as to color the entire body of the water a dense green.

6. Food Manufacture

Photosynthesis becomes an obvious process on a sunny afternoon when the student can see bubbles rising from submerged plants, collect the bubbles by upward displacement of water and establish by a chemical test that the gas is oxygen. Two large jars set side by side, with corresponding kinds and amounts of vegetation but one in bright sunlight and the other covered with wrapping paper, show the effect of light on photosynthesis. With the same two jars, both in sunlight but one heated to 30° C. and the other cooled to 15° C., the effect of temperature can be tested. The oxygen content of the water can be tested by any of the standard chemical methods. If this is done early in the morning before photosynthesis gets well under way and again late in the afternoon after a day of food-making activity by the plant, a relation is seen which is obvious in its importance to animals.

7. Feeding Habits of Animals

We have observed in the course of a single class period the feeding activities of such a variety of animals as the clam, snail, crayfish, bass, sucker, catfish, water snake and soft-shelled turtle. The aquarium enables the student to see many details that could not be brought under observation in the native habitat of the animal. The student understands what is going on when he watches the catfish "cruise" along with dragging barbels ready to detect food particles. Observation of the moving mouthparts of the crayfish makes dissection meaningful. Several drops of concentrated aqueous methylene blue placed with a long dropper just outside the incurrent siphon of the clam will be taken into this siphon and after several seconds expelled from the excurrent siphon. The response of a bass or sunfish to an insect dropped on the surface of the water explains why bass and bullheads are not lured by the same kind of bait.

8. Respiration

A pupil can easily see respiratory movements of fishes, tadpoles, soft-shelled turtles and several other animals when these are in a clear aquarium only a few inches from his eyes. He can make certain conclusions when tadpoles and fishes come to the surface to gulp air. He can see mosquito wigglers hanging onto the surface of the water and can do the oil-film experiment for himself. In the same tank may be a soft-shelled turtle that has been under water for an hour and a half, a group of minnows gathered about the aeration outlet and a female crayfish with attached egg masses waving gently to and fro. Respiration activities can be studied in relation to photosynthesis and to changes in temperature. Measurements may be made of the oxygen content of water in which animals are showing signs of distress. The tolerance of various animals to low oxygen content can be studied and comparisons made.

(To be continued next month)

Books

PIEPER, C. I., BEAUCHAMP, W. L., AND FRANK, O. D. *Everyday Problems in Biology.* Scott, Foresman and Company, New York, 1936. 686 pp. $1.72.

Literary Style: Written to the student in a personal manner with frequent use of the words "you" and "we" the text is designed to capture the interest at once. As the title indicates, the author uses everyday problems and materials familiar to most students in the presentation of his subject.

Each of the twelve units is introduced by a "Story of the Unit" which relates in an informal way some interesting examples of relationships to be discussed in the unit and sets up further problems to be solved or offers questions which serve to stimulate further reading. The few paragraph headings that are used are always in the form of questions.

Explanations of biological phenomena are well made and in a manner which should be readily understood by a tenth grade pupil. New vocabulary terms are italicized when first introduced and the explanation is a part of the story which the author is telling, not a footnote definition at the bottom of the page.

Mechanical Make-Up: The book comes complete with a study book for pupils. A 316-page teachers guide book, a perishable standardized set of objective tests, and wall charts of Unit graphs. The engravings are profuse and have valuable, stimulating educational information to direct the pupil. They are well labeled and many are the smaller size of around $1\frac{3}{4}$ by $2\frac{1}{4}$ inches. There are fill-in charts, sharp line cuts and two multi-colored plates. The cover is of a firm pebbled finish with a well designed motif. The type is well spaced and readable.

Psychological Soundness: This text is organized into unit-problems on biological processes, written from the point of view of a child who is using certain facts to find the answer to a problem. Because their sub-problems are integral parts of the unit-problem, and because they are definitely planned to follow the Morrison technique of direct teaching, these units are integrated psychological entities.

Insofar as scientific method can be taught by the use of a book, this text should help in teaching it. In addition to the inductive development of the generalization, many of the study suggestions and the self-testing exercises provide for practice in inductive reasoning, or in some special technique of study. Moreover, in the accompanying workbook there are exercises devoted specifically to various aspects of the scientific method.

The numerous suggested activities, together with the additional exercises and the extensive bibliography provide sufficiently for individual differences.

The first four units show both a logical and a psychological sequence. The reasons for the particular sequence of the other units is less obvious. In general, the sequence is one of progressive difficulty.

An important difficulty in the use of the book is one that is inherent in the psychological organization itself. If a unit is studied exactly as it is written, the pupil should gain integrated concepts of the subject matter. If, under the necessity of fitting the book to a particular syllabus, or to the needs of a particular group of pupils, the teacher must pick and choose material from several sections of the book to present one topic, then obviously, the value of the psychological organization may be lost. Ninth and tenth year students will probably find the book interesting, although poor readers will find it difficut.

Subject Matter: Many teachers still treat plants, animals, and man in separate sections. They present in greater or less detail a number of separate species, studying their structure and life functions, and then use this body of facts to formulate the general principles of biology. But many modern texts are breaking with this traditional procedure which emphasizes the descriptive side of biology rather than the similarity of life processes. EVERYDAY PROBLEMS IN BIOLOGY admirably develops the unit plan of organization.

The book is divided into twelve units, each of which focuses the attention on some major life process or activity, treating each as a function of all living things. The student learns how living things obtain and use food, how they grow, how they depend upon their physical surroundings and upon each other, how they adapt themselves to changes in the environment, how they reproduce and how they behave. Other units show why living things behave as they do, and how they are classified and improved. A final unit answers the question: How is human life conserved? Each unit is made up of a number of problems. The most absorbing section is unit VI, How do plants and animals live together? It is developed by means of the following five problems: How do plants help other living things? How do animals help other living things? How do plants hinder other living things? How do animals hinder other living things? How is the balance of life maintained? Misstatements are extremely rare, e.g., that, in the insect, the air pipes or tracheae follow the course of the blood vessels (p. 95). The discussion of air, water, temperature and light seems to be treated in greater detail than is customary in biology texts. However, though intended for ninth and tenth-grade pupils, the book contains most of the matter that teachers have been accustomed to give and much additional material.

Learning Exercises and Teacher Aids: Starting from the very layout of the book, exercise units of functional biology, to the last pages consisting of glossary and index, this book is virtually a mass of learning exercises and teacher helps. The unit has an overview, a story, problems with study suggestions and then self testing exercises. This is repeated as many times as there are units. There are fill-in charts, thorough glossary, pronunciation lists, and an index. As noted elsewhere, there are teacher guide books with additional exercises stemming from the text. There is a study book, standardized tests, and wall charts; each in turn from the material of the text. In fact the neophyte to teaching appears to step into a paradise of help with the book and its numerous accessories, all combined to teach biology. The book appears to be an elaborated prescribed syllabus leaving the teacher little more than selecting the pages and elaborating the suggested demonstrations and experiments. An imaginative teacher will find difficulty in using this thoroughly set-up text. This collection might almost be a course, a teacher, a self-checking device, a laboratory and a school all in one. It leaves little for the teacher to do other than follow.

Alan Nathans (*Chairman*)
Marion Richter (New York)
Reverend Paul Keuehne (Canada)
H. Theodore Stubbs (New Jersey)
Irene Hollenbeck (Oregon)

McAvoy, Blanche. *A Study Guide for Biology.* Burgess Publishing Co., Minneapolis, Minn. ii + 235 pp. 1939. $2.00.

This laboratory study has been planned on a seasonal basis with sug-

gestions as to available materials and the time of year when they are obtainable. There are nine units which include insects, vertebrates, microorganisms, higher plants with special work on trees, food, human structure and physiology, reproduction and heredity. Each unit is subdivided into lessons of suitable length for laboratory study, with references to texts and supplementary reading material.

Careful descriptions, detailed directions for experiments and simple labeled sketches make the guide self-explanatory. Adequate space is allowed for drawings, records of experiments and notes. Practical questions and suggestions for supplementary work are designed to arouse and maintain interest. This may prove a very helpful guide in many biological courses which include the above topics.

RUTH A. DODGE,
Johnstown High School,
Johnstown, New York.

ADAMS, NORVAL E., and BANDOW, ESTHER M. *A Study Guide for Applied Biology.* Burgess Publishing Co., Minneapolis, Minn. iii + 113 pp. 1940. $1.50.

Laboratory study planned on a seasonal basis for the purpose of training the pupil to do independent and scientific thinking is the main purpose of this guide. It is divided into twelve units designed to show the application of the life functions. The topics include adaptations to environment, insects, other invertebrates, vertebrates, special study of man, bacteria and other "friendly enemies," higher plant life and heredity, with also one on conservation. Units are organized into problems with an outline at the beginning of each. Important facts or principles and pertinent questions are listed under the heading "You will need to know." Laboratory problems, many of which call for actual work in the field and suggestions for demonstrations are given, with space provided for results. "Additional activities" are designed to promote further interest in project work. This guide would be most useful in sections where distances to fields and streams are not great and where students could go in small groups to collect their material, provided it covers the work usually included in the specific biology course.

RUTH A. DODGE.

STILES, KARL A. *Laboratory Explorations in Animal Biology.* Burgess Publishing Co., Minneapolis, Minn. x + 158 pp. 1940. $2.50.

An $8\frac{1}{2}$ by $10\frac{3}{4}$-inch paper covered, spiral bound manual of the experimental type. It includes accurate, well planned directions mimeographed on the backs of the sheets, and 35 carefully executed drawings most of which are only to be labeled by the student.

The manual may be used with any text although it is specially adapted to Hegner's College Zoology. The sequence followed, from the simple to the complex, admits of treatment in the order most convenient to the instructor.

The exercises combined the desirable features of both the "type" and the "principles" method of study. Questions following each exercise serve as a review of textual material, apply factual material to biological problems, and stimulate library work.

Representatives of such forms as the Sporozoa, Anthozoa, and Scyphozoa are either omitted or included as class demonstrations.

It is questionable whether the mere

labeling of the outline drawings effectively impresses the structures on the minds of the students.

Unique features of the book are the motivation to discover, the fostering of the Scientific Method, the list of objectives found in the first few pages, the questions following each exercise, the glossary and the bibliography.

BROTHER H. CHARLES,
St. Marys College,
Winona, Minn.

EDGE, ROSALIE, and LUMLEY, ELLSWORTH D. *Common Hawks of North America.* Emergency Conservation Committee, New York. 26 pp. 1940. 10 cents.

An illustrated pamphlet dealing primarily with the economic importance of the hawks. It was written for use in schools, particularly in biology classes. Problems and questions and a list of general references are included.

WORKS ON CONSERVATION OFFERED

A "LIBRARY" ON CONSERVATION, consisting of a number of teaching aids and suggestions to promote conservation education and practice in both rural and city communities is announced by the U. S. Office of Education, which states: "Twelve bulletins, four of them available free, form a compact library of reference facts and recommendations in this field of education. If bound into one volume, the bulletins would produce a single 700-page source-book on the subject of conservation."

The titles and prices are:

Conservation in the Education Program	10c
Teaching Conservation in Elementary Schools	20c
Curriculum Content in Conservation for Elementary Schools	15c
Conservation Excursions	15c
Farm Forestry	15c
Conserving Farm Lands	30c
Landscaping the Farmstead	15c
Opportunities for the Preparation of Teachers in Conservation Education	5c
Good References for Conservation Education in Secondary Schools	Free
Good References for Conservation Education in Elementary Schools	Free
Good References on Conservation of Trees and Forests for Use in Elementary Schools	Free
Good References on Conservation of Birds, Animals, and Wild Flowers for Use in Elementary Schools	Free

Free publications are available from the U. S. Office of Education, Washington, D. C. Publications for which there is a charge should be ordered from the Superintendent of Documents, Government Printing Office, Washington, D. C.

THE REVIEW OF MEIER AND SHOEMAKER'S *Essentials of Biology* which appeared in the December issue of the journal was of an earlier issue than the current one. We are advised that a number of important changes have been made in the last edition.

RECENT GOVERNMENT PUBLICATIONS of special interest to biologists (obtainable free while the supply lasts from the Department concerned or from your Congressman) are the following:

Our forests: What they are and what they mean to us. Revised July 1940. 39 p. il. (Agric. Dept., Miscl. Pub. 162.) 10 cents.

Living and forest lands. 1940. 48 p. il. (Agric. Dept., Miscl. Pub. 388.) 10 cents.

Buying beef by grade. 1940. 8 p. il. (Agric. Dept., Miscl. Pub. 392.) 5 cents.

Gardenia culture. 1940. 8 p. il. (Agric. Dept., Leaflet 199.) 5 cents.

Technology on the farm. 1940. 224 p. il. (Agric. Economics Bureau.) 40 cents. "In this book we count the costs and values to American farmers of some

new changes in machines, animals, plants, tillage, and processes."

Studies on dental caries: 9, Prevalence and incidence of dental caries experience, dental care, and carious defects requiring treatment in high school children. 1940. 11 p. (Pub. Health Service, Reprint 2178.) 5 cents.

Eugenic sterilization in the United States, comparative summary of statutes and review of court decisions. 1940. 45 p. (Pub. Health Service, Sup. 162 to Pub. Health Reports.) 10 cents.

Inks. 1940. 77 p. (Natl. Bureau of Standards, Circ. 426.) 15 cents.

(Continued from page 127)

BEEBE, WILLIAM. *Camels and Men.* Bulletin of the New York Zoological Society 44: 117–126. July–August, 1940.

Mr. Beebe has here presented a view of the camel which is informative and delightfully written and illustrated. The camels of today are all domesticated, descendants of beasts used by man at least 2600 years ago. At birth, the adipose lump has not yet appeared, although the elbow, knee, and breast kneeling pads are well developed. When full-grown at ten or twelve years, an initial intake of fifteen gallons of water, stored in compartments of the stomach, suffices an animal for a four-day trip, carrying four to six hundred pounds thirty miles a day. Racing dromedaries may carry their riders 120 miles a day. Bactrians are more heavily built and slower, and can endure rocky ground and cold climates in their central Asiatic habitat. Horses display an inherent terror at any trace of camel odor. Besides transportation, camels provide their owners with milk, dung for fuel, meat, leather, and hair for cloth, ropes, and brushes.

ROBBINS, WILLIAM J. *Sugar.* Journal of the New York Botanical Garden 41: 177–181. August, 1940.

From 1830 to the present, the average per capita consumption of sugar in the United States has increased from ten pounds to 110 pounds. Sugar was almost unknown to the western world for many centuries; it was expensive, and was sold by apothecaries as medicine. Its general use as food began in the nineteenth century. The average production of sugar by a leaf exposed to sunlight is about one gram of glucose per square meter of green leaf surface per hour. A man requires 3000 to 4000 kilogram-calories per day as normal energy intake, the amount in 800 to 1000 grams of glucose. Hence it would require 80 to 100 square meters of leaf surface to supply a man with his normal daily food requirements.